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articles, "*loc. cit.*" may refer to a reference published in a preceding article, sometimes to one in a preceding volume. In one case approaching the limit of misuse, the statement in the text reads, "Harvard² and Princeton³ laboratories." The reference number 2 is to "*loc. cit.*" On looking at reference number 1 it is found that the word "Harvard" is not mentioned at all. In order to make sure that this "*loc. cit.*" did not refer to a reference in some preceding article, both the publications under number 1 would have to be noted and examined by any one unfamiliar with the fact that a man with a certain name, interested in a certain subject, was writing articles coming from Harvard in a particular year. This contingency will arise in some future time.

There are two classes of readers interested in the position of references. The reader who wishes only to see the date of a statement referred to in the text, or the name of the journal in which the statement was published, naturally finds it easier to look down at the foot of the page, instead of turning to the end. But the reader who wishes to look up an original article is willing to take this small trouble of turning to the end, especially when it saves time in the long run. Having had to read through articles, and look over references which ran in number into the hundreds of thousands, then look up thousands of the original articles from these references, I can speak from adequate experience of the positive value of the method recommended here, for it was always a pleasure and relief to come across the few articles using it.

Since there is a constant plea for saving of space in articles presented to scientific journals, a method of economy which will save from one half to one per cent. of the space now used, and at the same time increase the ease of looking up references and authorities, seems worthy of consideration.

HEYWARD SCUDDER

SCIENTIFIC BOOKS

Essays and Addresses. By the late JAMES CAMPBELL BROWN, D.Sc. (Lond.), LL.D. (Abdn.), Professor of Chemistry in the Uni-

versity of Liverpool. With a Portrait and Twenty-two Illustrations. London, J. & A. Churchill. 1914. Pp. x+208. Price \$2.00 net.

A memorial volume is always of interest to the former students of a loved professor and to such this collection of essays and addresses by the late Dr. Campbell Brown will chiefly appeal; but from another standpoint this book is of interest not merely to chemists, but to all who come into touch with chemical industry, in that it presents the opinions of a discerning critic, expressed from time to time in a more or less popular way to audiences interested in the development and utilization of chemistry. This is particularly true at the present time when so many are turning their attention to the applications of chemistry to conditions of war.

Of the twelve addresses, three were delivered as chairman of the Liverpool Section of the Society of Chemical Industry, five before the Students' Chemical Society of University College, Liverpool, and two before joint meetings of the societies of the same college. The period covered in these addresses is 1886 to 1908, and many of the thoughts are equally applicable to the present time, especially those dealing with education.

It is interesting to read in the address on Technical Education delivered in 1886, Dr. Brown's strong plea for linking a sound early mental training with education of the hands, an idea which has been developed in this country along the line of the manual-training schools. Dr. Brown would, however, solve the problem along somewhat different lines. He would have workshops for different kinds of trades erected in a few well-chosen districts of a town, and require each scholar to spend a sixth day of every week in one or other of these shops, such day being counted as a part of regular school attendance. A single workshop would thus serve for a considerable number of graded schools, and the workshop day would be looked forward to as almost a holiday. He says: "By this system I do not think that the amount of ordinary school work would be lessened; but if it were, the decrease would

be very slight, and the reply to objections is, that some provision for training the hands and muscles to work is essential to an embryo workman, is beneficial to an embryo gentleman, and must be had at any sacrifice if we, as a nation, are to maintain our position in the face of other competing nations." This idea is in a few instances carried out in this country as regards higher technical education and with apparently good results, and would probably be better in our high schools than the present diversion of a part of our boys to manual training schools. But the greatest advantage would seem to be with the children in the grades.

Again Dr. Brown takes issue with the prevalent craze for a *practical* education in the sciences. "In the teaching of science it is a great mistake to aim *specially* at imparting a knowledge of facts which will be of use in after life. It is the desire to do this which has gone a great way in encouraging the multiplication of science subjects in schools. It would be far better to teach one science subject substantially and well than to teach a smattering of several. Every boy and girl, in whatever sphere of life, should be taught one science as a part of ordinary school training, but the mistake is too frequently made, both in science teaching and in ordinary school routine, of forgetting that it is the mental training and discipline, and not the storage of facts, that form the valuable feature of school work—the training of the understanding and the development of the reasoning faculties rather than the exercise of mnemonics." He considers that natural history, either vegetable or animal, is best adapted to the purpose of training the powers of observation and classification.

Again emphasizing the same idea in another address: "The use or object of education is not to impart a number of facts useful or otherwise, nor even to give useful hints and receipts that will enable the scholar to pursue some particular occupation; not to enable him to earn a living, or to earn a better living. That will follow, of course, as a secondary result of education, but its direct objects are of a far higher character. (1) To train the mind and its various powers, memory, reason, habit of precise

observation, and arranging things which resemble each other and distinguishing things which differ. (2) Not so much to impart knowledge as to awaken the faculties and give the power of acquiring unlimited knowledge for oneself. (3) To cultivate the sense of the beautiful, not only of artistic beauty, which is of a material and physical kind, but a sense of intellectual order and beauty also. (4) And in all these ways to increase the happiness and the capacity for happiness of human beings." And then he adds: "If, in the course of education, some store of facts can be acquired at the same time, so far so good—for life is short—but that is not the first object of education."

To the young employees in the various works and mines of England he would send this message: "It is not merely by attending faithfully to their routine duties and performing them to the satisfaction of their employers that the Germans are beating them as clerks, beating them as inventors, beating them as workmen, beating them as manufacturers, beating them steadily in the markets of the world—for it is true that the Germans are doing all this—but because every German boy and girl, for more than two generations, has received a broad and thorough education, at institutions where every one is compelled, not merely to do routine lessons, but to think and train his intelligence; to learn principles and apply these principles in many practical ways; and unless the young Englishman engaged in industrial or commercial pursuits will set to work earnestly to broaden and deepen his education by systematic study after he has left the ordinary school, it is certain that the German, who is rapidly replacing the Englishman in some of the markets of the world, will replace the Englishman at home also. I do not doubt that the Englishman can, by his energy, beat the German as he has done in the past, but at present he is not doing so, and he is not even training himself in the right way for the struggle of life." "During my last visit to some of the industrial parts of Germany, I was very much struck, as every one would be, by the immense advance which was apparent as compared with a previous visit. Not only the employers, but the em-

ployed, are men of education. The managers and heads of departments, often those who are analogous to what we should call foremen in England, have a university education. All have spent many more years on their education than is usual in England."

In an address on "The Ethics of Chemical Manufacture," Dr. Brown would have the manufacturer remember that he has other and higher privileges, and that nobler duties devolve upon him than those which necessarily occupy the greater part of his thoughts during business hours. The satisfactory thing to contemplate in the development of the alkali industry is not the fortunes it made, nor even the employment it gave to thousands, but that it gave cheap and abundant means of cleansing self, raiment and dwelling to every family among the civilized nations of the earth. Balard is revered now not because he manufactured so many thousand kilos per week of salt from the sea water, but because, experimenting one day with the mother liquor, he observed for the first time some reddish-brown vapors, and followed them up, and became the discoverer of bromine. "Joule doubtless made excellent beer, because he is the sort of man who does everything well he undertakes; but his great work for which the world is indebted to him, and by which he will be remembered with gratitude throughout all time, was his determination of the mechanical equivalent of heat, whereby he laid the foundation of chemical dynamics and of the science of thermal chemistry, as well as brought about a revolution in an important branch of physics." The coal-tar dyestuff industry is not looked upon with much favor by Dr. Brown. "When one sees the glaring colors which are now flaunted before the public eye, often without any thought of harmony and with no consideration of appropriateness of position and surroundings—in advertising placards, house decoration, dress and so forth—one is sometimes tempted to ask whether the production of these new dyes has been a good thing for mankind, and whether, when our last mines are worked out and coal-tar dyes cease to be manufactured,

the world will be any better for having had them, and whether the huge industry, which is at present flourishing, is not a waste of time, and of carbon compounds that would be better saved to keep us warm in winter—whether, at least, its highest merit is not that it affords a present means of livelihood to so many thousand workmen." The knowledge gained from the study of coal-tar products is the real justification of the "waste"; "this, rather than cheap alizarin, gaudy bills, brilliant shop windows and rainbow-colored dress, is the thing of which the coal-tar manufacturer should be proud."

A most interesting chapter is the address, "Reminiscences of August Wilhelm von Hofmann." Dr. Brown was a student in Hofmann's laboratory in the school of mines, and the story of the great master in lecture room and laboratory is most entertainingly told, with delightful personal touches. Here also we find most favorable views of German industry as he speaks of Hofmann's students and assistants working from nine in the morning till six at night, and often returning after dinner to work privately till a late hour. "That is the kind of work which tells. An eight-hours day may be all very well for working men who have no ambition and who are content with daily bread (and beer); but a gentleman has to work much harder."

There is included in the volume Dr. Brown's translation of the autobiographical fragment of Liebig, which originally appeared in the *Deutsche Rundschau* for January, 1891, and which is of great interest; and also a single original investigation, "Aquiculture: a Study of Deposits in Pipes and Other Channels Conveying Potable Water," read before the Institution of Civil Engineers. Altogether, the book as a whole is well worth perusal, both by chemists and by the general public.

J. L. H.

SCIENTIFIC JOURNALS AND ARTICLES

THE July number (Vol. 16, No. 3) of the *Transactions of the American Mathematical Society* contains the following papers: